

NISTTech

Approach to contacting nanowire arrays using nanoparticles

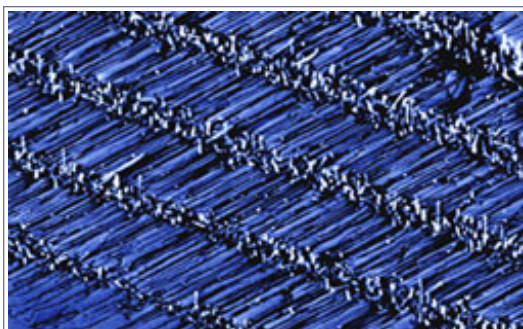
Grow and precisely align semiconductor wires only 3 nm in diameter

Description

Grow well-formed, single-crystal nanowires in place—and in a predictable orientation—on a commercially important substrate. The method uses nanoparticles of gold arranged in rows on a sapphire surface as starting points for growing horizontal semiconductor "wires" only 3 nanometers (nm) in diameter. These electrical contacts to nanowire assemblies are established through non-destructive methods.

Arrays of nanowires made of zinc oxide may be grown with precise alignments. The gold "anchors" are placed with a chemical etching step and the orientation of the wires—horizontal, vertical or at a 60 degree angle from the surface—is determined by tweaking the size of the gold particle.

Images



Scanning electron microscope image shows rows of zinc-oxide nanowires grown on a sapphire surface with gold nanoparticles visible on the end of each row

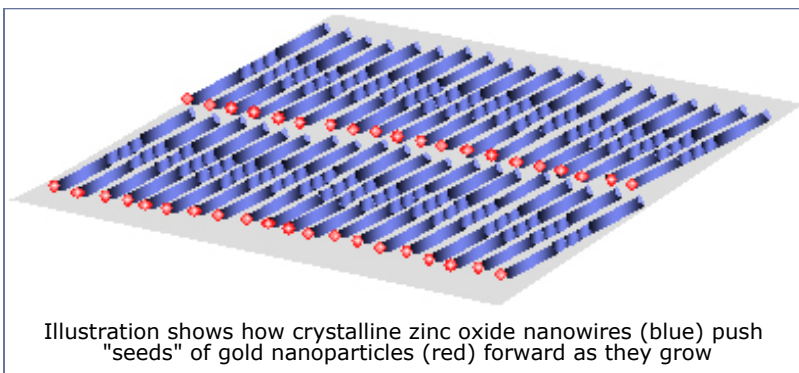


Illustration shows how crystalline zinc oxide nanowires (blue) push "seeds" of gold nanoparticles (red) forward as they grow

Applications

- **Nanofabrication**
Link or create nanoelectronic devices
- **Gas sensors**
A significant building block for solid-state gas sensing equipment

Advantages

- **Economic fabrication**
Fewer production steps required
- **High quality**
Production process has greater precision

Abstract

A new approach towards electrically contacting the top of an aligned nanowire or nanotube array using a conductive nanoparticle film has been developed. This contact method allows surfaces along the length of the nanowire or nanotube to remain untreated. Previously the only way to attach electrical contacts to the non-substrate ends of vertically oriented nanowires or nanotubes involved attempts at filling the spaces between the nanorods with some material. This would be followed by some kind of electro-polish to expose the top ends of the nanorods, over which a continuous film would be developed. In such a process contamination of the nanorods by the fill material, and contamination at the metal contact interface posed problems. In the new approach, only the contact material is present. Briefly, conducting nanoparticles (metals such as gold, silver etc.) are generated, charged and deposited onto the sample containing the nanowire or nanotube array within an electrostatic precipitator. The electric field enhancement from the tips of the nanowires (or nanotubes) is utilized to attract charged nanoparticles exclusively onto the top of the array. The result is an array of standing nanorods with a continuous and porous top contact layer.

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Related Items

- Article: Gold Nano Anchors Put Nanowires in Their Place

References

- Serial # 12/111,696 dtd 4/29/2008; pub #US 2009-0032801A1 dtd 2/5/2009; Expires 11/21/2029
- Docket: 07-009

Status of Availability

This invention is available for licensing exclusively or non-exclusively in any field of use.

Last Modified: 12/28/2010